With the Author's Compliments

Cotton

Reprinted

FROM THE

# TRANSACTIONS

OF THE

# British Mycological Society.

1913.

WORCESTER:
EBENEZER BAYLIS & SON, STEAM PRINTERS, 22, THE CROSS,
AND TRINITY WORKS.

## PRESIDENTIAL ADDRESS.

*By A. D. Cotton, F.L.S.*

### SOME SUGGESTIONS AS TO THE STUDY AND CRITICAL REVISION OF CERTAIN GENERA OF THE AGARICACEAE.

Our gathering at Haslemere this week constitutes the 17th annual autumn meeting of the British Mycological Society. Since the foundation of the Society in 1896, autumn forays of a week's duration have been held every year, and during the last five years short spring meetings have been held in addition. Their object—the promotion and advancement of the study of our British Fungus Flora—is attained not only by the handling of a large number of fresh specimens, but also by mutual co-operation and help. The fungus season as generally understood is a short one, and consequently we who are engaged in the study of the larger fungi (especially the Agaricaceae) find these opportunities of examining fungi in company with fellow mycologists to be of the greatest value.

It is highly gratifying to be able to state that the British Mycological Society was never in a more flourishing condition, nor was the output of work by members greater or better in quality. For this satisfactory state of affairs most hearty thanks are due to our able Hon. Sec. Mr. Carleton Rea, whose whole-hearted interest in its welfare, only those who know something of the inner workings of the Society can fully appreciate.

The autumn forays have been held in some of the best and richest woods in England, and on three occasions members have been tempted as far north as Inverness-shire, whilst the woods of Wales and Ireland have also been explored. Haslemere is, however, the first centre to which we have been attracted a second time; the fine hunting and good sport we enjoyed here eight years ago having given it a front place in our memory. The late Sir Jonathan Hutchinson kindly placed his museum at our disposal on the occasion of our first visit, and gave us a hearty welcome, and had he lived he would doubtless have again been a distinguished visitor at our meetings. This year we are indebted to the Trustees of the Haslemere Museum, and we

have also the valuable assistance of Mr. E. W. Swanton to whose guidance the success of the former meeting was so largely due.

When we met here in 1905 we enjoyed the genial company and valued help of three eminent mycologists who are now no longer with us, Mr. Arthur Lister, Dr. C. B. Plowright, and Dr. W. Watson. The late Prof. Marshall Ward was moreover Vice-President the same year. The loss to the British Mycological Society of men such as these is incalculable. Marshall Ward's work and stimulating lectures have left their mark on mycology, and we are proud to record in our Transactions the results of some of his researches and also two presidential addresses. The works of our two other former presidents are in the hands of every mycologist, indeed it is not too much to say that Plowright's Monograph of the British Uredineae and Ustilagineae, and Lister's Monograph of the Mycetozoa rank amongst the most important works ever produced on systematic mycology. The former, published in 1889 and containing the results of years of labour and investigation, has held a unique place, and if now out of date this is only owing to the great advance since made in the subject. Of the place held by the Mycetozoa Monograph there is no need to remind this Society. The thoroughness of Mr. Lister's work is known to all, and by common consent, his treatise has been regarded as a model of accuracy and detail. With equal care and skill Miss Lister has prepared the second edition, and by its publication the Monograph is brought up to date and the Mycetozoa are now elaborated in a manner unrivalled in any group of the lower organisms with which the botanist has to deal. In connection with their work, it is a suggestive fact that both Plowright and Lister though eminently systematists were also greatly interested in the morphology and life-history of the organisms they studied.

With such examples as these before us, members of the British Mycological Society have no excuse to lag behind. Although few of us can expect to attain to their standard, their example of careful observation and perseverance is a great incentive to us all. There is plenty of scope in our own country, quite apart from the work of adjusting our floras to those of the Continent and America, or from working our collections of fungi from the colonies. A sound knowledge of the British Flora is of the greatest importance, and is, as we shall see later, from some points of view an urgent necessity.

I wish to speak this evening on the study of our British Agaricaceae, and to consider it from the standpoint of critical work with a view to the production of revised descriptions. My address may be divided into three parts, dealing with, (1) the need of such revision, (2) possible lines of investigation, and (3) some practical suggestions with regard to the methods of secur-

ing results. When dealing with a subject such as this, many questions come before us, but time permits only of our touching upon some of the more important.

1. With regard to the need of a more accurate knowledge, I will only mention two points. The first concerns our British plants. It is common knowledge that many species are either inadequately, or inaccurately described, whilst almost all groups are burdened with descriptions of "bad" species. The second point arises from this, and is connected with the naming of foreign collections. In national institutions, such as Kew and the British Museum, collections of fungi are constantly being received from abroad and from the colonies, and in dealing with these lack of precision in descriptions in our European floras is often painfully apparent.

To give a concrete example, we recently received at Kew a fine collection of plants from the Falkland Islands, and amongst the Cryptogams were a number of Agaricaceae. These proved to be mostly small pasture plants (species of Hygrophorus, Mycena, Galera, Stropharia, etc.), and were preserved in spirit accompanied by coloured drawings, sporecasts and notes. The other groups of Cryptogams could be fairly accurately determined, and it was possible to obtain an idea of the flora as a whole and of its geographical relationships. But the Agarics would for the most part defy the most daring mycologist, and this was the more provoking since they appeared to be extraordinarily similar to our own. Details as to size and texture are not so noticeable in dried or spirit material, and drawings however good can rarely give the range of colour in the same way as a series of fresh specimens. One had perforce therefore to rely rather largely on microscopic characters, but these features in mycological works are but scantily alluded to. One very ordinary looking Psathyrella, for instance, was found to possess three-pronged cystidia at the gill edge, but in the floras cystidia in the genus Psathyrella are scarcely mentioned, though on examination they are found to occur in almost all species. We see therefore that the identification of foreign specimens is hampered by the insufficiency of the description of our own species.

It is only right however to add that with foreign collections the difficulty is more often reversed, that is to say, the trouble is not with the poorness of the existing descriptions, but in the extreme difficulty of obtaining a correct idea of the specimen before you. It was the attempt to name Ceylon fungi from the imperfect knowledge gained from dried material and poorly executed drawings, that resulted in the "mycological chaos" so vividly described on more than one occasion by Petch (v. Trans. B.M.S. 1911, p. 340). But things have now improved, and spirit

material accompanies in many cases the dried specimens and drawings. With the help of this we can trace the affinity of the species more clearly though even now correct naming is often impossible. The chief asset in the spirit specimen is the preservation of form and of microscopic structure, and as it is on the latter that we largely rely the neglect of micro-characters in European handbooks is a great loss.

During the last few years collections of fungi have been sent to Kew from India, Burma, Malay States, Nigeria, Uganda, New Zealand, Queensland, New Caledonia and West Indies, and in all cases where fleshy Agarics are concerned great difficulty is experienced. Thus we find that these extra-European collections exert a reflex-action and throw us back on the study of our own flora. I say our own flora because it is representative, but to be correct the flora of all countries where pioneer mycologists were at work should be included.

Turning now for a moment to the Basidiomycetes as a whole, we find considerable progress has been made in the study of the group. German botanists have worked hard with the Uredineae, and as a British contribution we welcome the volume by Mr. W. B. Grove. The Gasteromycetes have also received attention, and the British species of Lycoperdon are now fairly sharply defined. The same may be said of the Clavarieae. Owing largely to the energies of Mr. C. G. Lloyd, the Polyporeae of the world are becoming much better understood, and with comparatively little critical work the British species could be easily settled. The Thelephoreae are also receiving attention and it is a source of great satisfaction to know that our member, Miss E. M. Wakefield is undertaking the revision of the difficult resupinate genera.

But when we come to the Agaricaceae the positon of affairs is different. The vastness of the family, and the transient nature of their sporophores, render their study exceptionally difficult, and it will be some time before we can expect more than revisions of genera and local monographs. The French have been active in producing such memoirs, critical and otherwise, but much further work is required. One of the few monographs of a genus is that on Inocybe by Mr. Massee (1904), and the lines adopted by him marked a distinct advance. Another genus on which we expect much light is Coprinus. From being one of the most perplexing we hope, as a result of Professor Buller's painstaking researches, shortly to find it one of the most thoroughly known and most accurately described. But with these and a few other exceptions our knowledge of the Agaricaceae has made little progress. A large number of species have been described in various countries, but we lack coherence and in many ways Fries' volume *Hymenomycetes*

*Europaei*, published all but 40 years ago, is still the best available. As I said at the outset my object this evening is to suggest some lines of work which we may profitably pursue, in the hope that by pulling together we may contribute something to the general advance, and this forms the second and main section of my address, to which we may now pass.

2. In systematic work of the nature indicated, two spheres of labour may be distinguished, the purely botanical and the bibliographical or literary, the latter dealing with questions of old names, synonomy, etc. Both spheres are necessary, and for success the worker must know something of each. Except, however, for a few passing remarks, we will confine ourselves to-night to the botanical side. With regard to macroscopic characters these are substantially the same as field characters, because being mostly lost on drying they must be ascertained whilst the plant is fresh. Microscopic characters on the other hand are to a certain extent capable of being preserved. These have in the past been largely left to the indoor man who as a rule deals also with the literary side. It is an aspect of the subject which appeals to him, since handicapped as he often is by living in a town, he values specially characters which will be recognisable in the dried or preserved specimen. It is to these microscopic characters that I wish to particularly refer, but I will first say a few words on field work.

Probably in no group of plants is the fresh specimen more important and the ordinary dried specimen of less value than in the fleshy Agaricaceae. The necessity of naming your plant within a few days or even hours after gathering is provokingly familiar to us all, and on account of this everyone recognises the need of studying the living plant. There is another reason why field work is important, and one which must not be overlooked by us who belong to the 2nd or even 3rd generation after Fries. That great master and all the older mycologists based their descriptions entirely on the morphological characters shown by the fresh specimen, and before we can use their names it is necessary to learn their ideas. Old names cannot be ignored, and any attempt to describe new species on microscopic characters, or even to amplify existing descriptions by this method, without a good training in the field and a sound knowledge of the views of older writers only leads to confusion. I wish to emphasise this point as the comparison of spores or other characters expressible in micro-millimetres has at times proved so fascinating that ordinary external features have been neglected.

But in these days of vegetation-surveys it is hardly necessary to press the importance of field work. One of the bye-products

of ecology is the very subject before us, namely, the renewed study of our common native plants. If systematists have shown ecologists the importance of a knowledge of species and varieties, ecologists have driven systematists to reinvestigate their own flora. This applies equally to fungi, though so far mycologists have not received much of the wholesome and stimulating criticism of the keen ecologist. There is no reason, however, why ecology should not be extended to fungi, and that their taxonomy should not be investigated from a more comprehensive standpoint. The various conditions under which growth takes place should be recognised and the effect noted. The chief factors at work may be grouped together under two heads, edaphic and climatic, that is those concerned with soil and climate respectively. If such subjects as these be included in the investigation it will at once be seen that a large field opens before the systematic mycologist. The edaphic conditions consist of not only the master factors of geological formation, and phanerogamic vegetation, but others such as the acidity, porosity, and water content of the soil, the presence of humus or certain mineral salts. The most important climatic factors are those of temperature and rainfall, three aspects of which have to be considered, namely, those inducing what are termed weather, season, and climate. Other factors such as drying winds or salt-laden breezes likewise have their effect. These two classes of factors, the edaphic and climatic, also determine in the main the phanerogamic vegetation, hence they exercise in addition an indirect, though very important, influence on the mycological flora and vegetation.

In mentioning these factors it is not the ecological *analysis* of our fungus flora that I have before me, interesting as that would be, but the study of the effect of habitat on the individual, in other words, of the form assumed by the same species under different conditions. We are all familiar with the short hill-side form, and the tall, long-grass form of certain Agarics, and in the case of well-known species recognise the difference as being the result of habitat. But in other cases the influence of conditions may not have been appreciated, and we have one species under two or even three names. To eliminate these "bad" species much field work is required, and also an intimate knowledge not only of the species itself but of the genus as a whole.

Another field character not to be overlooked in systematic work is that on which Mrs. Carleton Rea lays so much stress namely, the question of age and a good series of specimens. For an accurate description we must know all stages of the plant. The scurfiness of the stipe and pileus is well known to vary with the age, and a succession of colour-changes may take place. The

latter is not confined to the pileus but is also found in the gills, and it may, as Mr. Rea has lately shown us in the case of Hypholoma, be of more value than has hitherto been supposed. A good series of specimens is specially important when the question of a veil or ring has to be considered, and I have a strong suspicion that amongst such genera as Hypholoma and Psilocybe several plants which are now separated on the ground of the presence or absence of a veil are really forms of one species in different stages of development. But here again the influence of ecological factors, notably weather-conditions, must not be disregarded. Other points of a similar nature will suggest themselves, but enough has been said to show that in this work of revision first-hand critical work in the field is essential.

We will now turn to the microscopic characters. It may be well to begin by assuring any member who is suspicious as to the use of these for the larger fungi, that no serious changes will be advocated, nor is it likely that any great "splitting" will follow. It is undeniable that Agarics possess certain well-defined micro-characters, which may or may not be of diagnostic value. What we wish to do is to ascertain their nature for each species so as to amplify our descriptions; then to test their value, and make use of them when possible for systematic purposes. We do not expect them to supplant field characters, but to supplement them, though experience has shown that in many groups micro-characters have been of the highest value.

At the Baslow meeting of this Society Professor René Maire gave an elaborate account of his method of investigating the genus Russula. He dealt with the microscopic structure in great detail, and his paper is invaluable for anyone wishing to take up that line of investigation. It would doubtless be instructive to examine in similar detail the histology of the gill in all genera, but for our present purpose it is hardly necessary, and we will confine our attention to the study of the spores, cystidia, and the structure of the gill-edge.

Taking the spore first, as being most commonly examined and generally admitted to be of importance, we find surprising differences in the descriptions given in our floras. The usual points to be noted are the form, size, colour and sculpturing. More than one member of the Society has remarked that it would be worth while to publish revised lists of the spore-characters of the Agaricaceae. On attempting this, however, a difficulty arises which is both instructive and encouraging. If two or three members compare notes, it will be found that as regards well-known species their records are in tolerable agreement, but with little known and questionable species there is often great diversity. This shows, on the one hand that the spores of the well-known species are fairly constant, and on the other, that these

bodies may possibly be of service in helping to separate those species which are doubtful or similar to each other in external appearance. My own work has been almost confined to the purple and black spored sections, and in those groups it is unquestionable that in certain genera the spores form a most useful diagnostic character.

There can be little doubt that wrong determinations account for a large percentage of discrepancies as to spore-characters, but other factors may be partly responsible, and some of these I will take the opportunity of briefly pointing out. In the first place there is the question of *age*. Immature spores differ considerably from those which are ripe, hence only mature spores, that is those which fall readily from the gill should be examined. In the second place we have the selection of *typical* spores. As a rule it is best to give the dimensions of an average spore, and to state also the ordinary variations. Odd spores which are exceptionally large or small are abnormal, and should not be included in the description. Thirdly, certain spores show *characteristic variability*. Just as some Agarics are singularly constant in the field and others singularly variable, so in some species the spores are particularly uniform, and in others, particularly inconstant. Allowance therefore, must be made for this. The variation liable to occur under these three headings is familiar to all, but there is a fourth source of error which I believe is not so generally recognised, namely that due to the presence of *ill-nourished* spores. Such spores are apparently infrequent in nature, and occur under special conditions, the chief of which is probably sudden desiccation. I hope to speak about this for a few minutes to-morrow evening. So much for causes of variation. If the pitfalls alluded to be avoided, there should be small danger in the use of spores, and I have no hesitation in saying that with a little experience, their value will be appreciated.

We now pass on to cystidia. Much light has lately been thrown both on the structure and function of these bodies, and, incidentally, on their value to the systematist. Their presence on the gills of Agarics is much more frequent than is generally supposed, and they occur in one form or another in nearly all genera. In the dark spored section it is quite the exception to find species in which they are absent, and Mr. Massee, who has been working for some time with the Leucosporae, tells me that they are surprisingly numerous in that section also. In the genus Coprinus, the cystidia are large and conspicuous, and Buller was the first to demonstrate that they acted as spacing agents or props to keep the gills apart. In other genera they are smaller and serve an entirely different purpose. Knoll investigated several widely separated members of the Agaricaceae,

and he believes that the small hair-like cystidia, or trichomes as he terms them, are really hydathodes, that is bodies serving for the secretion of superfluous moisture. The exudation takes place at the apex of the trichome, and in some species the cell-wall at this point swells to such an extent, that it forms a colloidal solution in the excreted water. In alcohol material this is sometimes very clearly seen. I have noticed it frequently in *Tubaria furfuracea* and in several species of Stropharia.

Cystidia are not quite so easy to examine as spores, and a certain amount of practice and technical skill is required. My own method is to harden the material in alcohol, and then cut tangential sections through the pileus. This gives transverse sections of the gills, when the form and number of the trichomes are well seen, though a little dissection, and pressure on the cover-slip, may render things even clearer. In a surface view of the gill these structures are often so delicate as to be invisible. As far as I can judge at present, the trichomes on the gill surface are not so generally useful to the systematist as the spore, or gill margin; but in some cases they are without doubt of a certain value.

This brings us to our third micro-character, namely the gill-margin. René Maire recognises three types, homomorphic, heteromorphic, and sub-heteromorphic. Homomorphic when the edge is of the same structure as the surface or lateral face of gill; heteromorphic when, owing to the presence of cystidia or other elements, it is different; and sub-heteromorphic when there is a preponderance of hairs or cystidia which are already present in small quantity on the surface.

Now it is a remarkable fact that when cystidia are present on the gill-surface, the fringe on its margin is very often composed of trichomes of the same type. In some cases moreover the scurf on the stipe, and occasionally on the pileus also, is formed of precisely similar outgrowths. I observed this point myself in some species of Galera, and have since noticed that it had been recorded by more than one writer. Into the meaning of the fact I do not enter, but it is an exceedingly convenient one for the mycologist, as with a little experience of the genera in hand, the type of the surface cystidium will be evident by simply examining the gill-margin.

The lantern slides to be exhibited to-morrow show the gill-edge of some of our well-known Hypholomas and Strophariaș, and you will notice the variety in the size and form of the trichomes. Now if our floras had some record of this gill-margin it would confer a great boon to mycologists dealing with collections sent from abroad. The species I shall show you are all common well-recognised forms, but there can be little doubt that in others equal variety obtains. This is the case in certain

species of Galera, Naucoria and Psathyrella, as to which, when one requires definite distinguishing features, it is very difficult to obtain uniformity of opinion. I can confidently recommend the gill-edge as worthy of study, and feel sure that it will prove of value for systematic purposes. As however the subject is still in its infancy it is important not to base conclusions from insufficient material, or to be unduly hasty in publishing results. It may be added that the small short gills appear at times to be less supplied with trichomes than those of full length, and, that it is always necessary to examine young or fairly young plants. On old gills the trichomes usually wither away, whilst if kept under close, moist conditions (e.g., in a closed vasculum) abnormal processes of various kinds are apt to develop.

This concludes my remarks on the microscopic features. For the sake of convenience we have considered the subject separately from that of field characters, but if any good work is to result, both lines of study must be followed. With regard to microscopic characters these doubtless vary as do all others, but it is quite possible that just as changes in macroscopic features may be connected with differences in habitat, so variations detected by the microscope may be found to be correlated with certain definite external conditions.

3. Having considered the need that exists for critical investigation, and surveyed some of the lines of study which may be profitably pursued, it remains to discuss for a few minutes the methods of work and co-operation likely to give the best return.

A certain amount of work has been done, but the results are hardly satisfactory. Critical remarks on field characters are of general occurrence in the literature, and scattered observations on microscopic features are plentiful enough. In papers on morphology and development, there is often an excellent account of the gill-structure. Local floras sometimes supply spore-measurements, and occasionally also notes on cystidia. But when we come to look at these observations from our present standpoint, we are repeatedly pulled up by discrepancies so great that they compel us to doubt, not so much the correctness of the observation, as the correctness of the identification. This difficulty meets us everywhere, the only exception being in the case of a monograph or a revision. Of papers specially devoted to micro-structure perhaps the most comprehensive is a series of useful contributions by Frau Paula Demelius, of Prague, in each of which she deals with a number of species belonging to various genera and groups. This method appears at first sight to be one by which the detailed description of all species might in time be acquired. But in practical working, it is somewhat disappointing. Frau Demelius finds her observations often differ from those of

other writers, and my own in some cases differ from both. It is quite certain that the discrepancies are not entirely due to variation, but, partly and probably largely, to wrong determination, or, to a different understanding of a given species in different countries. If we were content with noting only generally recognised plants, this diffused method of dealing with all species just as they come to hand would be useful, and, to those engaged in colonial mycology, of real value. But there is a tendency to exceed this limit and then the work is practically useless.

There can be no question that the only really satisfactory method is the monograph. It is slow, but the results are much more likely to be sound. Known species become better understood, and little known and unknown plants gradually find their proper position. A comprehensive monograph of any genus of the Agaricaceae is of course at present out of the question, but the monographic principle,—concentration on a given genus or group—can be followed, and we should at least be able to produce a series of critical revisions of British species.

It would no doubt be desirable to include continental forms, but for this the time has hardly come, and for the present it seems safer, and indeed preferable, to confine our research to native species.

Our Society has plenty of latent energy, and I am quite sure that with a little co-operation and mutual stimulus such revisions could perfectly well be produced. We have already learned the value of co-operation in systematic mycology. Berkeley, Cooke, Plowright, and Lister, all had a whole band of correspondents who assisted them by supplying specimens from all parts of the country. The general response to the appeal for material of Clavaria and later for resupinate fungi, shows how willing to help members of the Society are when research work is in hand. Lloyd's work on Puffballs and Polypores was carried out in the same way. But if assistance was needful for such groups, how much more is it necessary for the short-lived fleshy Agaric. Prof. Buller has made a beginning with Coprinus and we have an opportunity of helping him to bring that genus to order. With regard to other genera there seems to be no reason why a few that are familiar and fairly simple, should not be taken in hand at once.

The mycologist responsible for a given revision must be prepared to work out the necessary microscopic structure, and to undertake the literary work, but if it is to be carried out in the right spirit, he must above all things be a field man. In addition to drawings and notes, a dried and spirit collection of numbered samples should be made. Other members would help as opportunity permitted, and in all cases they should supply data as to ecological conditions and as to the field characters of the speci-

mens forwarded. In the later stages of the work a good library will be essential, and sooner or later the assistance of that at Kew or the British Museum will be required.

Such are the suggestions I would lay before you. General work should still be encouraged, but if we are to advance, we must specialize, and it seems to me that the production of some of these much needed revisions of British species would be one of the most suitable and at the same time most useful pieces of work which our Society could carry out.